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POTENTIAL OF JAVANESE HANDWRITING CALLIGRAPHY (HANACARAKA) FOR COGNITIVE THERAPY

Neurology

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ABSTRACT

Javanese calligraphy (hanacaraka) is a derivative of the Devanagari letters, also known as hanacaraka. Javanese script is estimated to have started to be used in the Islamic Mataram era in 1608. This letter is used in various manuscripts in the form of chronicles, poetry and other literary writings. There has been no writing in the form of a review related to the potential that can be used for therapy. The users of this letter are Javanese, the number of Indonesian people and it is officially taught at the elementary & junior high school level in the provinces of Central Java and East Java. We will describe the forms of Javanese letters and their potential use from the Neuroaesthetic side.

KEYWORDS

Javanese, calligraphy letters, manuscripts, Neuroaesthetic, therapy, cognitive

INTRODUCTION

Chinese calligraphy research on neuropsychiatric effects has been carried out for 30 years now. Literature studies show that many studies and clinical trials have been carried out. The main thing that underlies the use of Chinese handwritten calligraphy is because of the geometric shapes that train the brain's visuospatial abilities. Also, when using a writing instrument, the author's body moves in various positions. Here are some of the latest research related to Chinese handwritten calligraphy.

Based on the literature review, we got several studies related to the therapeutic effects of calligraphy writing.

Thirty students and academic staff in Taiwan who were proven to suffer from stress by the General Health Questionnaire were randomized into 3 groups, namely the Chinese handwritten calligraphy group, the meditation group and the control group.Examination of physiological parameters before, during and after therapy. Result: Chinese handwritten calligraphy has the same effect as meditation and has the effect of reducing stress.(Kao, Lam, & Kao, 2018; Kao, Zhu, & Chao, 2014)

Sixteen under graduate students were randomized into calligraphy groups and control groups. One subject is experienced in writing Chinese handwritten calligraphy for more than 3 years, the rest have little experience. Subjects were asked to write Chinese characters based on the geometric visuo-spatial system which includes closed forms, linear symmetry, parallel, connectivity, and orientation. Forty characters are selected to be worked on by the subject for 10 days. Writing calligraphy for the calligraphy group was 20 minutes per session, after a standard test was carried out before writing 6 minutes 43 seconds. The following geometric Chinese calligraphy include the following (figure 1):

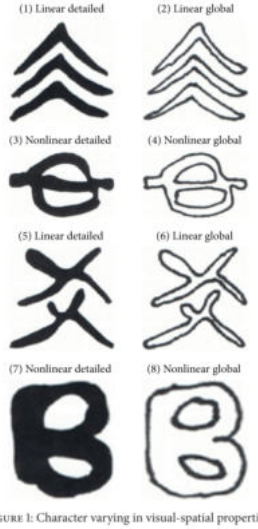

FIGURE I: Character varying in visual-spatial properties.

EEG recording is done with software on a laptop with 10 – 20 systems. The result is that there is a significant difference in the calligraphy group at the beginning of the study, the results of which are lower frontal midline waves than the control group. Meanwhile, at the end of the study, the calligraphy group showed an increasing trend in the average frontal midline theta compared to the control group.(Xu, Kao, & Zhang, 2013)

A single blind randomized controlled trial was conducted on 31 adults aged > 65 years with mild cognitive impairment in the calligraphy group and the control group. Chinese calligraphy training was carried out for 8 weeks. Before and after training, the MMSE Chinese Version (CMMSE) was checked globally and scores increased in the cognitive, attention and calculation areas after 2 weeks, this is in contrast to the control group who experienced a decrease in CMMSE at the end of the study..(Kwok, Bai, & Kao, 2011)

Ninety-nine subjects with mild cognitive impairment were randomized into 2 groups: control and calligraphy. 48 people in the calligraphy group and 54 people in the control group. Conducted training for 2 weeks. The results showed that there was an improvement in working memory in the training group compared to the control group.(Chan, Derbie, & Hui, 2017)

Conducting a meta-analysis study of CCT (Chinese Calligraphy Therapy). CCT results show a curative effect on neuropsychiatric symptoms, but the evidence is insufficient, so large randomized controlled trials are needed..(Chu, Huang, & Ouyang, 2018)

Currently, research related to neuroaesthetics is being developed. The art aspect studied is related to cognitive neuroscience.(Ashoori & Eagleman, 2015; Boccia, Barbetti, & Piccardi, 2015; Brattico & Pearce, 2013; Brattico & Varankaitė, 2019; Chatterjee, 2006; Chatterjee & Vartanian, 2016; Dubinsky, Wood, Nespoli, & Russo, 2019; Ferreri & Ernest Mas-Herrero, 2019; Garza-Villarreal, 2016; Iigaya, P.O'Doherty, & Starr, 2020; A. M. Jacobs, 2017 ; R. H. A. H. Jacobs & Renken, 2012; Järvelä, 2018; Kreutz & Bongard, 2005; Kringelbach & Berridge, 2017 ; Mima, Sadato, Yazawa, & Takashi Hanakawa, 1999; Nadal, 2013; Nadal & Skov, 2013, 2015; Nalbantian, 2013; Peck, Girard, Russo, & Fiocco, 2016; Rachel J. Bar & DeSouza, 2016; Sachs, Ellis, Schlaug, & Loui, 2016; Särkämö, Ripollés, & Vepsäläinen, 2014; Sihvonen & Särkämö, 2017; Sun, Han, & Jiang, 2020; Zheng, Huang, & Li, 2016) Javanese letters in handwritten calligraphy have characters that meet the basic concept of beauty in art theory, namely: symmetry, rhythm, harmony, pattern, proportion and variation.

There have been many f-MRI-based studies related to the active part in the brain when doing artistic activities and starting a work of art.(Wang, Mo, & Ce Mo, 2015). When judging something beautiful, it will lead to neurochemical changes in the brain in the form of pleasure which can be used for various therapeutic purposes.(Alluri & Brattico, 2015; Christensen & Gomila, 2018; Chu et al., 2018 ; A. M. Jacobs, 2017 ; Kringelbach & Berridge, 2017 ; Nalbantian, 2013; Särkämö, 2018 ; Wang et al., 2015) Based on the things above, the following is an analysis of the Javanese letters.

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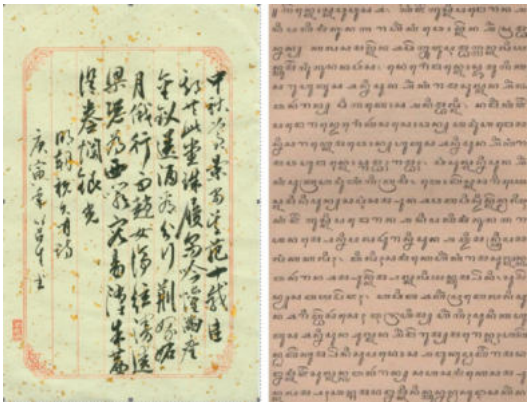


Figure 2. Chinese and Javanese Manuscripts.

Javanese Calligraphy and Aesthetics

Javanese letters have characters that can be studied from an aesthetic point of view. In general, Javanese characters have firm lines with a combination of formations that require flexibility to write them. Javanese letters have a decorative structure, where this structure fills all fields of view, on top left, top right, bottom left and bottom right. A few letters fill the central field of view (figure 2).

Vowel sounds a, i, e, u, o are formed with special punctuation marks. This shows an element that can be used to train predictive in spatial expansion related to visuo-spatial. These abilities require the cerebellum to function normally. If we are going to write a consonant in the middle of a word, you need a letter formation called a "pasangan". (letters that indicate consonants) are made using symbols in the form of formations under the previous letters, which require good spatial expansion abilities that are influenced by the function of the cerebellum.

Figure 3. Vocals

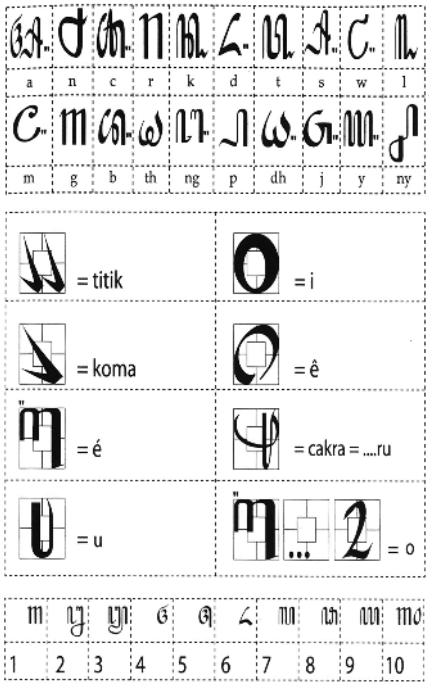


Figure 4. "pasangan" and many additional symbols.

Consonants / consonants in the middle of a sentence (not at the end of a sentence) called a "pasangan".

Comparison of Javanese calligraphy with calligraphy that uses cognate letters.

Javanese calligraphy comes from the development of the letters used in the previous era, namely the Kawi (ancient Javanese) letter. Here is an example of calligraphy with kawi (ancient Javanese) letters.

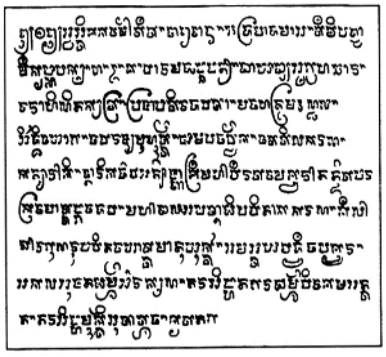
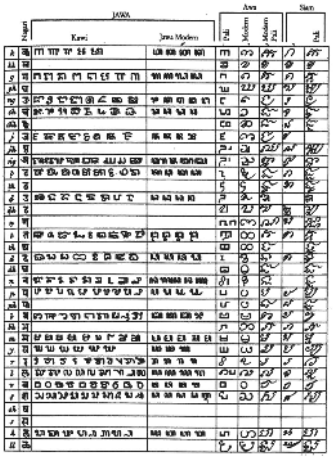


Figure 5. An example of the kawi letter obtained from one of the inscriptions, and placed in the museum of culture and science in Jakarta.(Saleh)

Kawi letters / ancient Javanese very reveal traces of the influence of the Pallawa script (South India). Kawi letters seem less decorative. Many letter ornament lines are broken and short, so it is not appropriate to evaluate the brain's ability to form lines and curves that require flexibility in changing the direction of the line. Kawi letters look too flowery with ornamental elements so that they are less practical to learn and memorize (figure 5).

Javanese letters are decorative spatial as follows (table 1):



Devanagari consonants when compared to some languages such as Javanese and Siamese

Table 1. The table above shows the comparison of Javanese letters with cognate letters. Elements of neatness and decorative spatial are highlighted in Javanese letters.(Saleh)

The following is an example of a cognate letter that is contemporaneous with the current Javanese letter is the Sundanese letter. This letter fills the field of view top left, top right, bottom left, bottom right.

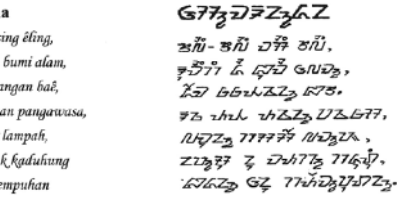


Figure 6. Sundanese letters (right).

Study of Javanese Letters Based on Prefrontal Functions.

Practicing writing Javanese letters greatly strengthens the decorative spatial elements. To make the following Javanese letters, a good prefrontal brain function is needed. Here is the letter "ha" when rewritten like a test performed to assess standard prefrontal function (figure 7).

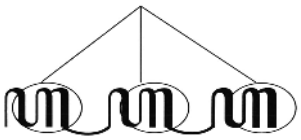


Figure 7. Javanese letter "ha"

If the patient experiences disinhibition/disruption of the brake system, the formation that will occur is:

Figure 8. A prediction of disinhibition stroke patient in writing javanese letter "ha".

So, Javanese letters can be used to test prefrontal ability and detect inhibition such as stroke in the prefrontal cortex (figure 8).

Javanese Letters To Assess The Function Of The Basal Ganglia

Study of Javanese letters based on basal ganglia function. Basal ganglia play a role in achieving the targets set and related to the reward circuit. When the target is reached, dopamine is released which causes a feeling of pleasure. The success of achieving the target in writing letters in Javanese calligraphy allows it to create "pleasure". The basal ganglia are also an important system when flexibility is required in drawing the direction of the line.

Example 1:

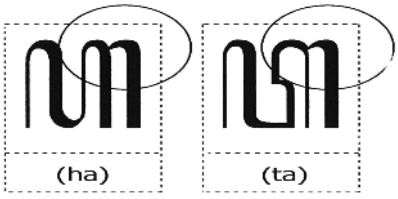


Figure 9. The similiarity between letter "ha" to "ta"

Change letters Becomes requires flexibility.

Example 2 :

= this is the letter (ba) in a consonant state (b).

Pay attention to complex turns and require prefrontal function (brake ability), ganglia basalis (flexibility to change direction) and cerebellum.

The function of the basal ganglia is needed to make the rounds of very complex letterforms. Above this formation can only be made if the basal ganglia are in good condition.

Example 3:

Javanese letters require more activity from the basal ganglia (part of the brain for flexibility/flexibility of body movements) because there are many turns, rotations that require flexibility or flexibility so that the letters formed are not disjointed. Compare the letters pa ( ) with latin letters p → This letter has 2 simple strokes, 1 line and 1 bending bend.

Writing the letter "p" hardly needs to exert the flexibility of the brain. Javanese letters on average have curves that are quite varied to train spatial abilities that are not found in Latin letters. The curve forms an angle ranging from less than 90 degrees, 90-180 degrees, even 360 degrees of ornament rotation.

Right Brain

Javanese letters can be used to assess right brain function as:

- Art feeling center
- The center of spatial ability or orientation of the location of objects in space.
- Center for creative ideas.

This part is highly stimulated when making Javanese letters, with the result that creative ideas are also stimulated to emerge, because the right brain is the center of activities that involve feelings as well as the center for the emergence of creative ideas. The right brain is stimulated properly, it will also make it easier for creative ideas to arise

Javanese letters to assess the function of the cerebellum

- ability to measure distance accuracy (prediction center).

Example 1:

The character ga to sound go is added with two signs and , on the left and right becomes

Figure 10. Javanese letter "ho".

To write this word, requiring the ability to view expansion space left and right. The implication for brain is to train expansion and practice prediction of space adequacy to put additional marks (the part of the brain that works is the right brain and cerebellum).

Example 2:

Javanese script contains a wider spatial expansion than Latin characters (figure 11).

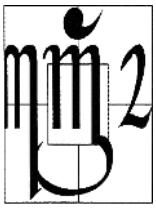


Figure 11. Javanese letter for word "grong".

For the letter ga to sound gro, the arrangement of the letters above is added with an "expansion" of letters to a lower field of view to become .

Furthermore, to sound "grong" then the expansion of the field of view is continued to the front and back and up to

Example 3:

Writing Javanese letters requires more effort than Latin letters because many symbols require left-right space expansion, up, down, even under letters, we can still add more signs.

for example “suku” sign the word "nglurug"

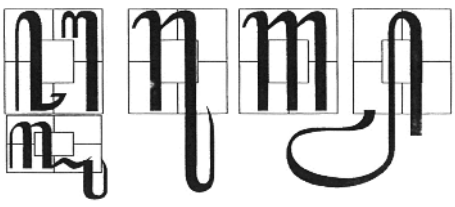


Figure 12. Javanese letter for word "glurug”

Example 4:

From a neuroscience point of view, it is clear that a prime function of the cerebellum (small brain) is needed to predict the location for alignment.

Compare this with placing a dot (.) at the top of the letter "i", if there is a very early cerebellar disturbance, a patient may not pay attention and the environment will also not care if the patient when writing the letter i puts a misst.

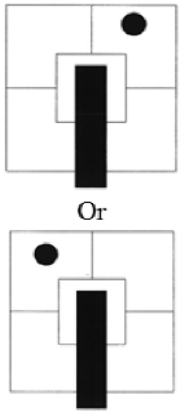


Figure 13. Ilustration Latin letter "I" related human visual field perspective.

because the dot is very small and escapes detection, but if you write "i" in Javanese letters it will appear. For example in the sentence:

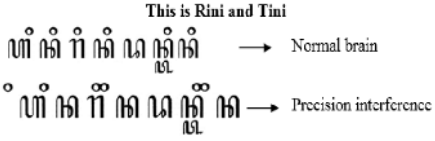


Figure 14. Javanese letter related visual field in making word sounds "ee".

All signs of the sound "i" above will be missed, and the patient will be detected more quickly the possibility of an early neurological disorder.

Study of Javanese Letters Based on Field of View

Several diseases in the field of neurology are related to visual field disturbances. In this example, if a person's field of vision is disturbed, it can be seen that he can't read the following letters easily.

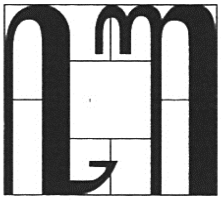


Figure 15. An axample of Javanese letter in visual field perspective.

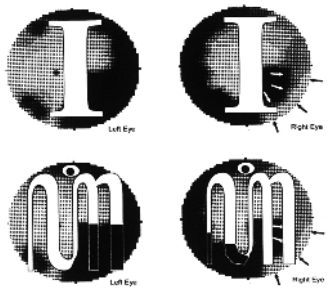


Figure 16. Patient Loss of Visual Field (dark) in the shape of a crescent moon. (Saleh)

As applied in the clinic, compare someone who sees Latin letters with Javanese letters in the same condition. It appears that if you look at the letter "I" with an abnormal visual field above, the patient can still "pass" from the diagnosis of loss of visual field because the letter "I" can still be read by the patient even though the edge of the field of view has been lost., But when you see the Javanese letter hi (ꦲ)then the patient will quickly detect a disturbance of visual fields because it is not clear what the structure of the Javanese letters is seen due to the part of the letter (ꦲ)many parts of it went dark.

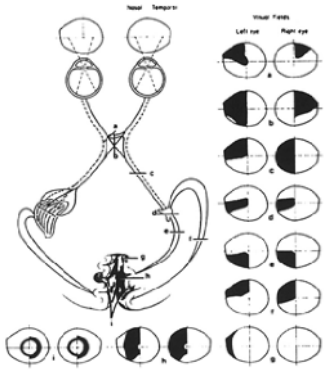


Figure 17. Summary of various forms of visual field loss due to disturbances along the course of the nerves from the eye to the brain due to various diseases.(Saleh)

Example 1 :

The following is an example of a comparison of Latin letters compared to Javanese from a decorative aspect (the fulfillment of an area by letter ornaments).

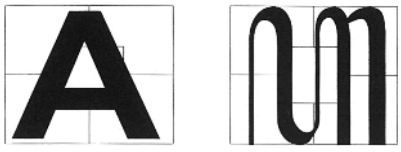


Figure 18. A comparison between Latin to Javanese letter based on visual field perspective.

By diligently practicing writing/reading Javanese characters, disturbances like the ones above will be detected more quickly. Some Latin letters contain a field of view that is indeed empty so that a person with impaired central field of view can still "pass" detection and still be able to read the letter (figure18).

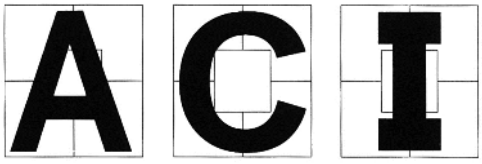


Figure 19. The white color in the box is a clear field of view not filled with letter-forming lines, a visual field perspective.

If the visual field is lost (in the middle) then the letter C can still be seen and read by the patient, as well as if the visual field is lost on the left or right side, then the letter I can still be read by the patient, because the letter I is not very decorative (many gaps). field of view that is not filled with letters). So if someone loses their field of vision on the top right, bottom, top left, and bottom, they can still read the letter I, so they don't know that they are starting to lose their field of view.

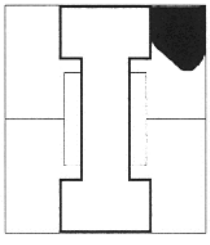


Figure 20. If it was a missing visual field (the Black color) existed, the patient still can read Latin letter "I".

Even though the visual field has begun to disappear (in the upper and lower right parts and the upper and lower left parts, the patient can still "escape"/undetected the disease because the ornamental structure of the letter I which does not take up much of the field of view, is still easily legible by the patient.

Example 2:
Javanese letters can be used for retraining / retraining the orientation of the space lost due to a stroke in the right brain called hemineglect, the left side is ignored by the patient. The patient is indifferent to his left side, even the left side of his body.

The patient does not care if someone is standing on his left. To detect this disorder the doctor will give the task of "usually" drawing flowers. Then the patient will draw a flower, sometimes with difficulty and the image will look like this (figure21):

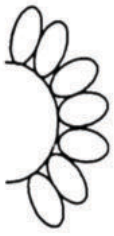


Figure 21. Only half of it will be drawn by the patient, this is called hemineglect.

The order to make this image is usually carried out with great difficulty, especially if the patient in addition to hemineglect also has severe depression. With a depressed state tasks ordered for examination purposes will be severely disrupted and threatened with failure. If for the purpose of diagnosis alone is disturbed, of course it cannot be continued at the therapy stage.

If the patient is a person who has good knowledge of Javanese culture, there are other "alternatives" that can replace the task for this diagnostic purpose.

Look at the Javanese letters ()(read yo) this does not require much energy to make, unlike drawing the flowers earlier. This letter is just one stroke without breaking from the bottom left corner to the top left, down to the bottom then up, down, up again ending at the bottom right, very decorative, all the main fields of view are reflected in this letter.

For someone who knows Javanese letters, he will be happy to carry out the doctor's orders to make these letters, as a result the doctor immediately knows that the patient has hemineglect or not.

Giving assignments with a cultural touch affects the patient's emotions and this can be used to support the examination in the hope of good cooperation through cultural emotions.

Javanese letters can be used to assess the accuracy of the patient's ability to maintain body position (proprioceptive).

In polyneuropathy patients (numbness tingling, a feeling of electric shock at the tips of the upper and lower limbs) due to diabetes, they will experience sensory ataxia, so far the neurologist has detected by telling the patient to stand up, the patient can still do this, by opening his eyes but when asked to close eyes, the patient will fall.

This happens because the proprioceptive nerves (detectors for changes in body position are disturbed due to uncontrolled high blood sugar levels that have damaged nerve function). When opening the eyes, the impaired proprioceptive nerves are closed by the lack of vision, which also plays a role in balance function.

If the patient with diabetic neuropathy above is asked to write with the letter I above.

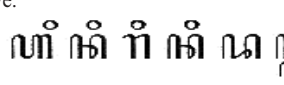
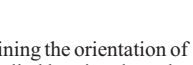


Figure 22. Javanese letter can use as an assesment for prediction of precission ability.

When instructed to write with the eyes open, the disturbed proprioceptive balance system can still be compensated (assisted) by the eyes, so the patient can still put sounds i (o) right above the letter  but when you are told to close your eyes, the formation (o) will not be able to make, let alone put it right because the patient is no longer able to detect changes in the position of the fingertips.

Classically, neurologists detect proprioceptive disturbances in the patient's fingers by asking the patient to close their eyes and gently move the knuckle of the index finger up and down. Patients with normal proprioceptive nerves will be able to answer which direction is the passive movement of the knuckles (figure 22).

Study of Javanese Letters Related to Mood
Javanese letters give a good "mood" effect, because they make Javanese letters "like batik activities". Making batik is drawing ornaments on a large area of cloth using wax. Batik is an intangible cultural heritage belonging to Indonesia that has been recognized by UNESCO. The appearance of mood (related to the limbic system in the brain) that is not excited is strongly influenced by the activities we think about.

This has resulted in the application in the clinic, the task/command of writing Javanese letters to patients can be used as retraining or "retraining" which is more successful than Latin letters, because it involves more emotional elements related to cultural emotions and beauty, so that can improve mood.

A good mood will make it easier for someone to learn something new that is more challenging and recall old memories, because memory is linked to a part of the brain called the limbic system and the Papetz circuit.

The element of beauty in Javanese letters can affect the "mood" because Javanese letters emphasize harmony in one letter and harmony between one letter and another. Every curve in one letter looks harmonious with other letters in terms of the rhythm of the letters.

Example 1:
Pay attention to the letters in the following sentences:

nglurug tanpa bala, menang tanpa ngasorake
(invade without troops, win without humiliating)

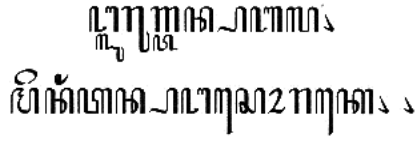


Figure 23. Example of an harmony in writing Javanese letters. .

There are elements of curves and lines that rhythmically match one letter to another. Javanese letters are very concerned about the element of beauty, in beauty there are elements of symmetry and balance.

a. Harmony in one letter, pay attention to the letter ba (O) There is harmony created from the balance of the composition of the letters above, the ornament is centered on the lower left and upper right sides.

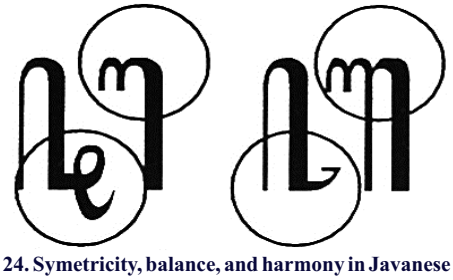


Figure 24. Symetricity, balance, and harmony in Javanese letter.

b. Letter compatibility

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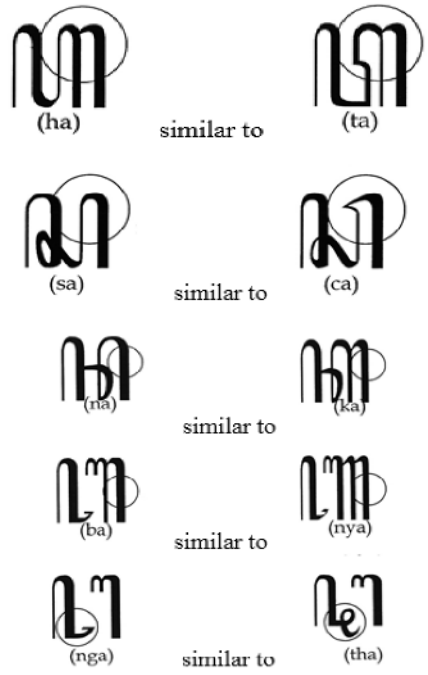


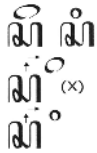
Figure 25. The similiarity of Javanese Letters. Symetricity is a componen of universal beauty.

If we look at the following series of sentences : Latin letters do not contain elements of symmetry and balance. The element of beauty in Latin letters only appears in the form of a line of letters in a straight line. Different things can be seen in the arrangement of letters that make up the following sentences::

Figure 26. Symetricity and balance in Javanese letter.

In summary, here is a comparison table of Latin and Javanese letters in terms of the 3 parts of the brain that play a role:

Table 2. The comparison between Javanese letters to Latin.

	Javanese letters	Latin
Ganglia Basalis	Flexibility/flexibility activities in changing direction flexibly and not sharply are more work because many curves must stop at certain formations. Example : ꦤ, ꦠ, ꦥ, ꦱ, ꦕ p, a, t, s, c	Only a few letters are Requires flexibility, some Latin letters still can be made without the element of flexibility but breaks broken (although broken can still be read)
Cerebelum	It is necessary to estimate the measuring distance and finger stability in form letters 	Relatively less need for finger stability compared to writing Javanese letters
Prefrontal Cortex	Writing Javanese letters requires higher attention/concentration due to more letter-forming line curves, brake activity is very necessary because many similar letter curves are repeated and one day have to stop to form letters that contain meaning.	Relatively less need for attention compared to writing Javanese letters

A Javanese letter-based brain exercise has been made based on the potentials described above. This hanacaraka brain exercise still requires further studies and various studies to ensure its therapeutic potential.

Based on observations, it appears that Hanacaraka's Javanese Calligraphy contains more curved or curved shapes than angular forms. Research shows that geometric shapes in the form of curves cause a calm response, while angular shapes cause an energizer effect. (Blazhenkova & Dogerlioglu-Demir, 2020).

Based on the above study, brain exercises were arranged with Javanese letter calligraphy based on the degree of difficulty. Research is being conducted to prove the clinical effect of writing Hanacaraka Javanese Calligraphy with various parameters to measure relaxation.

HANACARAKA BRAIN EXERCISE

1. Symmetry Exercise

Write the letter "ha" on the left side along with the right side with your eyes closed

Easy :

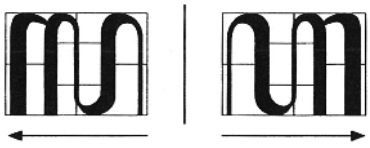


Figure 27. Javanese letter "ha" and a reverse writing of letter "ha", in order to exercise other brain hemisphere.

Medium :

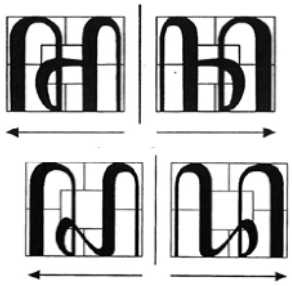


Figure 28. Javanese letter "na" and reverse letter "na" in order to exercise brain hemisphere contrary.

A bit difficult :

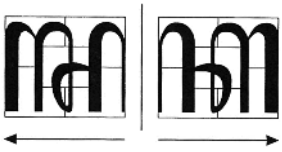


Figure 29. Javanese letter "ka " and reversed letter "ka" in order to exercise brain hemisphere contrary

Difficult :

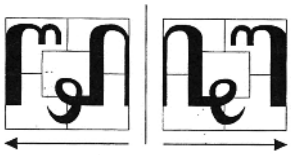


Figure 30. Javanese letter "tha " and reversed letter "tha" in order to exercise brain hemisphere contrary

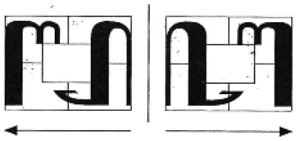


Figure 31. Javanese letter "nga" and reversed letter in order to exercise brain hemisphere contrary

Very difficult :

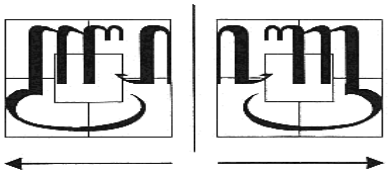


Figure 32. Javanese letter "nyra " and reversed letter "nyra" in order to exercise brain hemisphere contrary
(chakra sign)

2. Exercise the brakes of the prefrontal part of the brain (bottom front of the brain)

Easy : Write the letter "ha" repeatedly and connected 3 times simultaneously left and right side by closing your eyes.

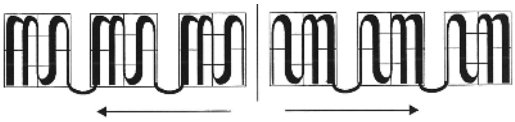


Figure 33. Assesment of prefrontal inhibition function.

Medium : Write the letter "na" repeatedly and connect it 3 times simultaneously on the left and right side by closing your eyes

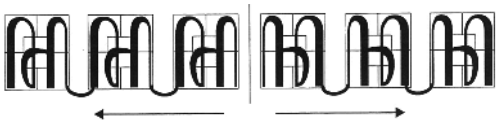


Figure 34. Javanese letter "na" and reversed letter in order to exercise brain hemisphere contrary

Difficult : Write the letter “pasangan ba" (consonant b) repeatedly and connect it 3 times simultaneously on the left and right side by closing your eyes

Figure 35. Javanese letter "pasangan ba" and reversed letter "pasangan ba" in order to exercise brain hemisphere contrary

3. Flexibility training
Easy : Write the letter "ha" and then the letter "ta", left and right symmetrically by closing your eyes.

Figure 36. Javanese letter "ha" and letter "ta" which is similar, and reversed letter "ha" and "ta" in order to exercise brain hemisphere contrary

Medium : Write the letter "ba" and "nya" left and right symmetrically by closing your eyes.

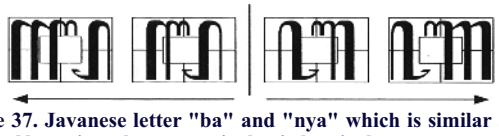


Figure 37. Javanese letter "ba" and "nya" which is similar and reversed letter in order to exercise brain hemisphere contrary

1. Exercise the accuracy of the expansion of the visual field inward. Write "ha" then change it to "he" with the addition of a symmetrical left and right taling sign by closing the eyes.

Figure 38. Javanese letter "he " and reversed letter "he" in order to exercise brain hemisphere contrary

2. Exercise the accuracy of the expansion of the field of view outward: Write "ha" then change it to "ho "with the addition of symmetrical left and right fighting tails by closing your eyes.

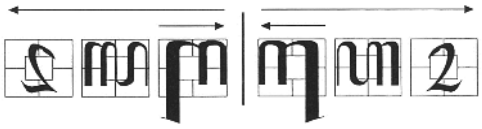


Figure 39. Javanese letter for making sound "ho" and reversed letter in order to exercise brain hemisphere contrary

3. Exercise the accuracy of the expansion of the field of view upwards.: Write "ha" then change it to "he" (pepet) with the addition of symmetrical left and right pepet by closing your eyes.

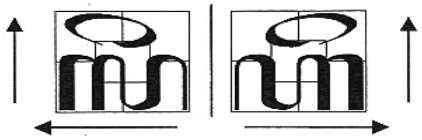


Figure 40. Javanese letter "ha" and reversed letter "he" in order to exercise brain hemisphere contrary

4. Exercise the accuracy of the downward expansion of the field of view: Write "ha" then change it to "hu" by adding left and right symmetrical syllables by closing your eyes.

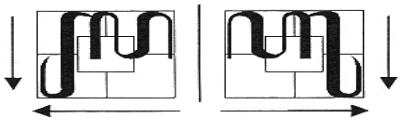


Figure 41. Javanese letter "u" and reversed letter "u" in order to exercise brain hemisphere contrary

5. Expansion exercises throughout the main field of view center, left, right, up, down, left-right simultaneously by closing the eyes. Write the word "srongpas", consisting of the letters sa, taling, tarung, chakra, and nasal marks.

Figure 42. Javanese word "srongpas" and reversed letter of the word "srongpas" in order to exercise brain hemisphere contrary

6. Cross practice
Easy : Cross the formation of the consonant/consonant “pasangan da" across the left and right center line

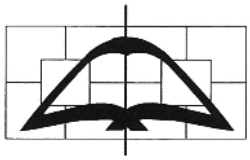


Figure 43. Javanese letter "pasangan da" and reversed letter "pasangan da" in order to exercise brain hemisphere contrary

Medium : Cross the pangkon formation across the left and right center lines

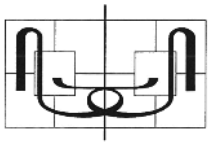


Figure 44. Javanese letter "pasangan ja" and reversed letter "pasangan ja" in order to exercise brain hemisphere contrary

Difficult : Cross the formation of the consonant/consonant "pasangan ja" across the left and right center line

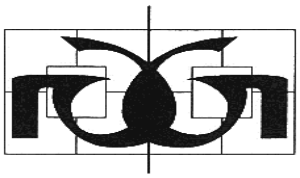


Figure 45. Javanese letter "pasangan ca" and reversed letter "pasangan ca in order to exercise brain hemisphere contrary

Very Difficult : Cross the formation of the consonant/consonant "pasangan ca" across the left and right center line

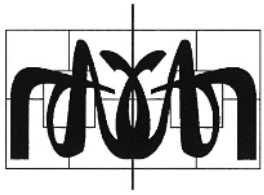


Figure 46. Javanese letter "pasangan ca" and reversed letter in order to exercise brain hemisphere contrary

7. Exercise the ability to write balance stability in a straight line.

Easy : Write a dot 10 times in a straight line simultaneously left and right with your eyes closed.

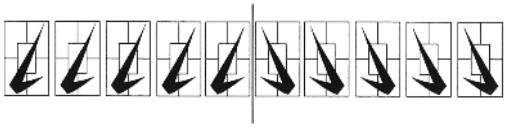


Figure 47. Javanese letter for a dot sign and reversed letter in order to exercise brain hemisphere contrary

Difficult : Write the sign e pepet 10 times in a straight line simultaneously left and right with your eyes closed.

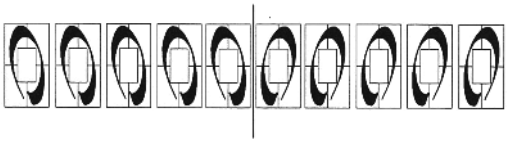


Figure 48. Javanese letter for making sound e pepet and reversed letter in order to exercise brain hemisphere contrary

CONCLUSION

We have described the potential of Javanese letters / Javanese calligraphy based on established theories, from a neurological and neuroaesthetic perspective. In the future, various studies are needed to prove the effect of therapy on improving attention, cognitive and behavior related to the improvement of anxiety and aggressiveness.

AVAILABILITY OF DATA AND MATERIALS

All data sources discribed in this study are directed at the corresponding author

DECLARATIONS

- Ethics approval and consent to participate

Nothing to declare

- Consent for publication

I, the undersigned, give my consent for the publication of identifiable details, which can include figures, tables and details within the text "Potential of Javanese Handwriting Calligraphy (Hanacaraka) For Cognitive Therapy" to be published in the above Journal and Article.

- Competing interests

Nothing to declare

- Funding

Nothing to declare

- Authors' contributions

A.Y.S. carried out the literature, analyzed the data, and wrote the manuscript. Conveniently, by having only one author, there were no decisions to make regarding author order or corresponding authorship.

- Acknowledgements

Nothing to declare

- Authors' information

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